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(58) Documents Cited

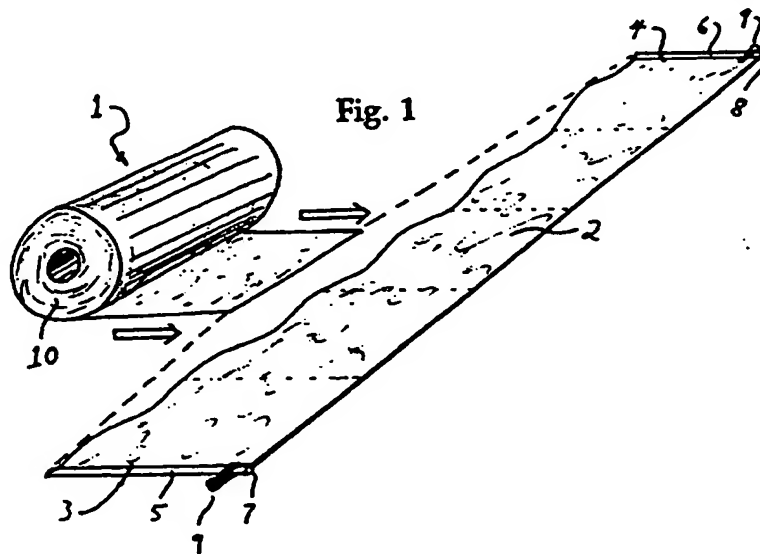
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(54) Covering for crops

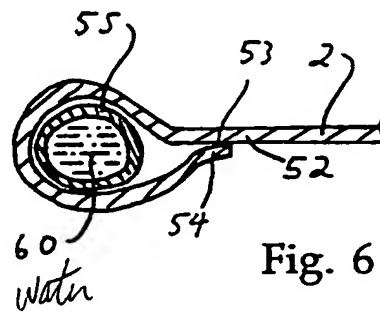
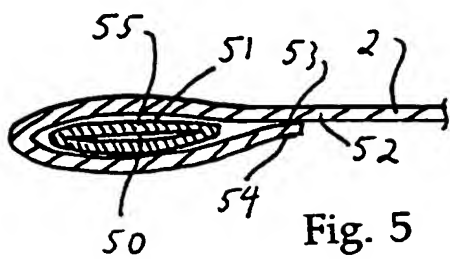
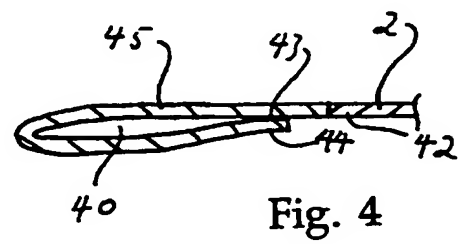
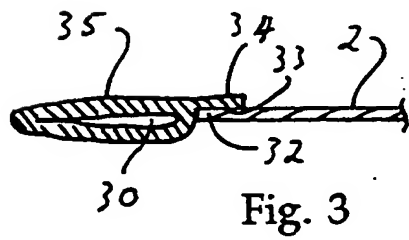
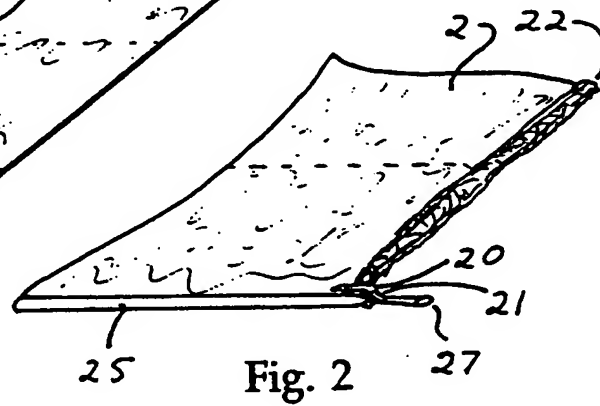
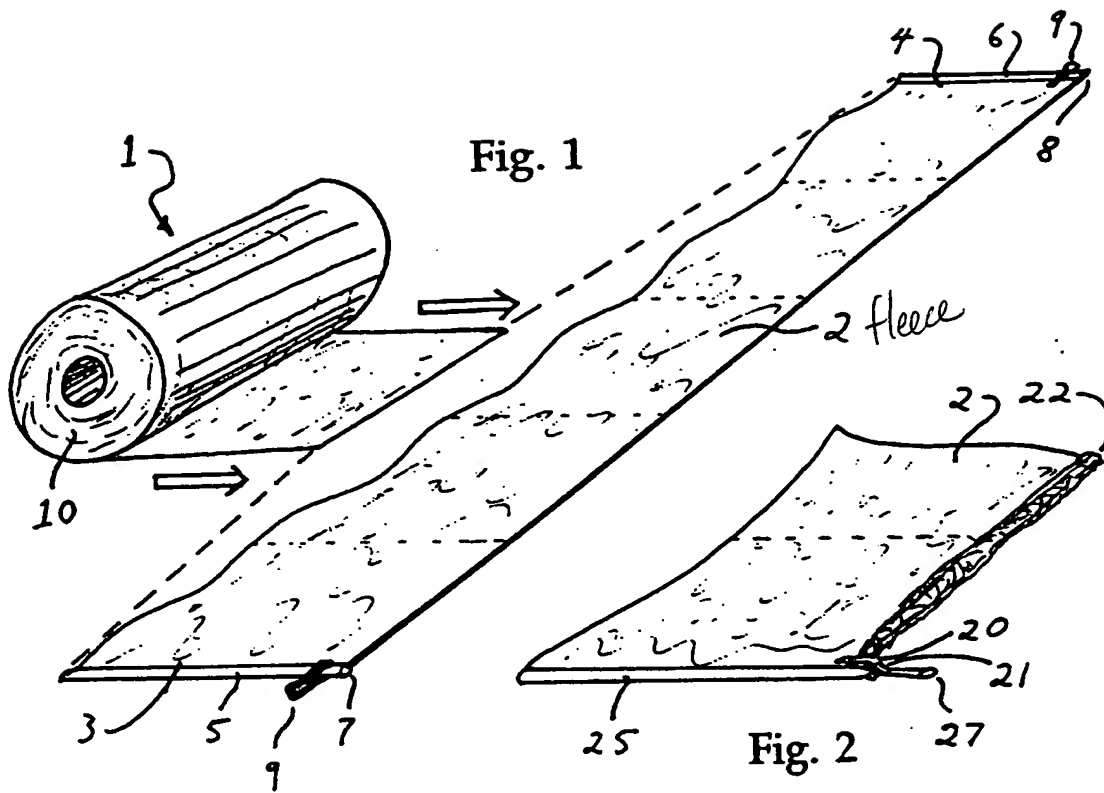
(57) The present invention relates to a covering to protect crops from cold weather. Along opposite edges 3,4 of the sheet 2, tubes 5,6 are filled with water to hold the sheet 2 on the ground and prevent the material from being lifted by wind. The tubes 5,6 have open ends 7,8, which may be pinched off with a clip 9, and water then introduced into the other open end, prior to closing the open end with a clip 9 to retain the water. Prior to removing the sheet 2 from the crops, the water is let out of each tube by removing a clip.



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1995

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Covering for Crops

5 The present invention relates to a covering for crops, and in particular to coverings which may be used to protect crops from cold weather or to contain chemicals applied to crops.

10 In recent years crop coverings, either of thin polythene sheet or of thin fibrous fleece sheet, have become widely used in agriculture or horticulture. These coverings are used mainly to protect certain crops during the late winter or early spring from frost damage. High value crops, such as lettuce and celery, are covered by long sheets of a translucent fleece material. Lower value crops, such as
15 potatoes, are covered by less expensive transparent polythene sheets. The fleece material is permeable to rainfall and has superior insulation properties. The polythene sheet must have holes to let in rainwater.

20 Polythene sheet with no holes is also used as a cover to keep in herbicide or pesticide gas, such as methyl bromide, in order to give the gas time to react with the soil or weed seeds, and to prevent the gas from escaping.

25 The fleece material is a synthetic textile material and is manufactured in a long thin sheet, generally folded and rolled up into rolls. The fleece material may be unrolled and unfolded in the field and laid over planted out crops by a team of people to present a wide light-weight continuous
30 covering, for example up to 12.6 or 13.6 m wide, which is then cut to the desired length, for example the length of the field, which may be of the order of 250 m or even 500 m long.

35 The sheet of fleece material rests lightly on the ground or

crops and is translucent to sunlight and permeable to rainfall. The temperature under this thin covering is raised in a greenhouse effect, making the crops grow more quickly, and protecting against frost damage at nightfall.

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The polythene sheet is also produced in rolls and generally laid on the fields before the crops have spouted. The polythene sheet may therefore be unrolled directly on the ground, pulled behind a tractor.

10

Because the polythene and fleece materials are so thin, they are readily lifted by the wind, and must be held down along the full length of the material, for example in a furrow between the crops, and also at the ends, generally at the ends of the field. One way of holding the material down is to use disused car tyres or sandbags. Another way is to use steel piping such as scaffolding pipe, which is then rolled inwards from the edges of the material to wrap the material around the pipe and so hold the material down.

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Polythene sheet may be dug into the ground around the edges, and while this may be done by an attachment on a tractor for narrow widths, say 2 m, wide widths are much more difficult to dig in. Space is also wasted between the sheets.

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It is heavy work carrying enough tyres or piping to lay along the full circumference of a long sheet of fleece material. The fleece can also be torn by contact with stones or other sharp objects, and the process of laying the tyres or pipes accelerates the damage to the fleece material, effectively limiting the life of the material to two seasons, after which it must be discarded.

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These problems are made worse by the fact that with many types of crop, the fleece has to be taken up at least once

before it is no longer needed, for example to apply pesticides to the crops.

5 It is an object of the present invention to reduce the effect of some of at least some of these problems involved in the laying and taking up of thin sheets over crops.

10 Accordingly, the invention provides, a covering for crops comprising a sheet which may be laid over the crops and at least one tube retained to the sheet, in which water may be introduced into the tube to hold down the sheet when the sheet is laid over the crops, and in which the water may be let out of the tube when the sheet is removed from the crops.

15 The sheet may be a material such as polythene, fleece or other such textile.

20 Also according to the invention, there is provided a method of covering crops with a covering, the covering comprising a length of sheet which may be laid over the crops and at least one tube retained to the sheet, in which water may be introduced into the tube to hold down the sheet when the sheet is laid over the crops, and in which the water may be let out of the tube when the sheet is removed from the crops, the method comprising the steps of:

- 25
- a) placing the covering over the crops; and
 - b) introducing water into at least one tube.

30 The tube is preferably retained along the length of at least one side of the sheet. As a rule, most fields have a slope and crops are planted with furrows running along the slope of the ground. Water introduced into an upper end of the tube will therefore flow under the action of gravity to the

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lower end, so filling up the tube. In fields where the slope is negligible, water may still be introduced into the tube under pressure to fill up the tube.

5 Although a tube may run along the length of the material away from the edges, for example along a centre line of the sheet, it is particularly advantageous if a pair of tubes are retained along the length of opposite sides of the sheet.

10

Furthermore, each of the two tubes may be adapted to be visually distinguishable from the other, for example by colour, texture or size, so that one side of the sheet may be visually distinguished from the opposite side. This is
15 helpful when a team of workers is initially laying out the sheet by hand. Before the sheet is weighted down with water in the tubes, the sheet can be caught by the wind and get out of control. The ability to distinguish opposite edges from one another allows any twists in the sheet of sheet to
20 be identified by the workers so that the sheet can be straightened out.

In order to reduce the volume taken up by the sheet when it is stored away or rolled up, the tube is preferably adapted
25 to lay flat when the tube is empty. A suitable material for the tubing may be a polythene plastic between 25 μm and 150 μm thick. Such a plastic tube may be manufactured with folds to enable the plastic to fold flat and exclude any air or water from inside the tube when not in use.

30

The tube may be attached directly to the sheet. Alternatively there could be an intermediate material between the tube and the sheet, for example, an intermediate strip of fabric more robust than the sheet, connecting the
35 tube to an edge of the material.

However, the tube may be attached to an edge of the sheet itself, and this may be accomplished in several ways. For example, the edge of the sheet may be wrapped around the tube to retain the tube. The sheet may then be sewn or
5 bonded to itself, so that the tube is held loosely inside an outer wrapping of sheet. Such a wrapping may help in protecting a tube from puncture, eg from stones or other sharp objects on the ground, and may also help prevent freezing of any water inside the tube.

10 Alternatively, the edge of the sheet may itself be bonded to the tube. For example, the tube may have a lip or flange which provides a means for attaching the sheet to the tube, for example by glue or by hot-press, ultrasonic or rf
15 welding techniques.

In another embodiment of the invention, the tube is integral with the sheet, which may be coated with a water resistant coating in a strip along an edge of the material, and then
20 folded back and bonded to itself to form a tube along an edge of the uncoated sheet.

In order to hold down the sheet, the tube, when full of water should weigh at least 0.1 kg per metre length of
25 tubing. In general, the windier the location of the field, or the wider the length of sheet, the heavier the water-filled tubing should be. In most cases, a weight of between 0.3 kg and 1.2 kg per metre length of water-filled tubing is sufficient. The upper end of this range may be provided by
30 tubing which is 38.1 mm in diameter.

The effectiveness of the weight of the water-filled tubing in preventing the sheet from being lifted or moved by the wind may be increased if the tube along one edge of the
35 sheet is overlapped over the tube along the edge of an

adjacent length of sheet. For a field covered by a large number of parallel lengths of sheet, this will reduce by nearly half the number of exposed edges of tubing. In some cases, it may also be possible to arrange the overlapping so
5 that the prevailing wind is transverse the lengths of sheet and in the direction of the overlapping.

In order to help prevent a tube being punctured by a stone or other sharp object, it may be desirable if the tube is
10 double walled, that is, a tube within a tube. Alternatively, a number of smaller bored tubes could be bundled together, so that if one were punctured, the others would still have enough weight to weigh down the sheet. In this regard, the term tube as used herein encompasses a tube
15 with internal partitions, either transverse or lengthwise.

Because the sheet is manufactured in very long continuous lengths, the tube may be just as long as the manufactured length of material. Since the material may be cut to
20 shorter lengths when placed over crops, the tube will most commonly be open-ended. Water retention means will therefore be needed at each end of the tube to retain water in the tube once the tube is filled.

In its simplest form, these retention means may be a knot tied, for example, by hand in an end of the tube. Alternatively, the retention means may comprise a valve press-fitted into an end of the tube. Such a valve may be retained by friction, or by a ring-clip or other such means
30 around the outside of the tube.

Another way of retaining water in the tube would be to apply a clip, for example, a spring loaded clip similar to a clothes peg, to the outside of the tube to pinch off water
35 flow past the clip. Such a clip could also be used to

isolate one end of a tube from the other. This would be helpful if it were necessary to lift part of a covering, for example, to apply pesticides. The clip could be applied to a tube half way along a length of sheet, one half of the tube would then be emptied of water, and that half of the material then folded back to expose half of the crops. The other half of the crops could then be exposed if necessary in like manner.

Generally, the length of sheet may be manufactured in a roll, unrolled in the field, cut to length if required, whereupon water is introduced into the tube. The water is then released and the sheet rolled back up into a roll when taken up from the crops. Means, such as opposing rollers, could then be provided during rolling up of the sheet to squeeze and expel any residual water in a tube.

The ends of the length of sheet may be held down in a conventional manner, for example with tyres or steel pipes, or by being dug into the ground.

The invention will now be further described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a covering according to the invention, showing a roll of fleece material being unrolled and unfolded, with two tubes along the edges of a length of fleece material and with clips placed to pinch off the ends of tubes;

Figure 2 is a perspective view of one corner of the length of fleece material of Figure 1, showing the end of one tube tied off, and with the end of the length of fleece material weighted down with a pipe;

Figure 3 is a cross-section of a first embodiment of the tube at the edge of the fleece material;

5 Figure 4 is a cross-section of a second embodiment of the tube at the edge of the fleece material;

Figure 5 is a cross-section of a third embodiment of the tube at the edge of the fleece material; and

10 Figure 6 is a cross-section of the third embodiment of the tube at the edge of the fleece material, when the tube is filled with water.

Referring first to Figure 1, a crop covering 1 in roll form
15 10 is taken to a field (not illustrated) and unrolled as indicated by the arrows to a required length. The roll is about 2.7 m wide, and once cut is unfolded as indicated by the dashed lines to yield a covering of fleece material 2 which is 13.6 m wide.

20 Along both opposite edges 3,4 of the length of fleece material are continuous tubes 5,6. The ends of the tubes 7,8 are initially open. Once the fleece covering has been laid out, one end of each tube is pinched closed by a clip
25 9 and water is then introduced into the remaining open end 7,8 of each tube, for example, by inserting a hose pipe into the open end. When each tube has been sufficiently filled with water, the remaining open end is pinched closed by another clip 9.

30 Figure 2 shows another way of closing off an end 27 of a tube 25, by making a cut 20 between the fleece material 2 and the tube 25 to free up the end of the tube, which can then be tied in a knot 21.

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The cut 20 also frees up the end of the fleece material, which can then be rolled around a steel pipe 22 to hold down the end of the length of fleece material.

5 Figure 3 shows a first embodiment of a tube 35 at an edge 32 of the fleece material 2. The tube 35 is made from a plastic material, such as polythene, and has a lip or flange 34 projecting from the tube. The edge 32 of the fleece material 2 is bonded to the tube 35 along a seam 33. The
10 interior of the tube 30 is illustrated empty of water and collapsed flat.

Figure 4 shows a second embodiment of a tube 45 at an edge 42 of the fleece material 2. The tube 45 is integral with
15 the fleece material, and is formed by impregnating or spraying the fleece material with a polymer or silicone compound to water-proof and strengthen the material, as is well-known to those skilled in the art of coating fibrous materials. The impregnated material is then wrapped around
20 itself in a loop, with the edge 44 of the impregnated material bonded to itself along a seam 43.

Figure 5 shows a third embodiment of a tube 55 at an edge 52 of the fleece material 2. The tube 55 is made from a
25 plastic material, such as polythene. An end 54 of the fleece material 2 is wrapped around the tube in a loop and bonded to the edge 52 of the fleece material along a seam 53. The interior of the tube is illustrated empty of water and collapsed flat. The tube 55 is separated from the
30 fleece material by a gap 51, as so is free to slide loosely inside the looped fleece material. The fleece material 2 therefore provides a protective external covering around the tube 55, helping to protect it from punctures.

35 Figure 6 shows the third embodiment of the tube 55 when the

tube is filled with water 60. The fleece material 2 and gap 51 also insulate the tube 55, helping to protect the water 60 from freezing.

5 One or both edges along the length of the covering may advantageously be colour coded to aid in identification of one edge from the opposite edge. The colour coding may be printed into the fleece material near the edge of the material, or around the tube. Alternatively, if the tube is
10 of polythene tubing, then the polythene could itself be coloured.

The fleece material commonly used is relatively fragile. For example, it can readily be torn by hand. Tears may
15 start at the edge of the material, particularly if the edge is held down by means such as disused tyres or steel pipes. Apart from eliminating potential damage by tyres or steel pipes, the tube along the length of fleece material may provide some longitudinal reinforcement or stiffness to aid
20 handling of the material when putting the material down or taking it up, so prolonging the usable life of the material.

A polythene sheet, although not illustrated in the drawings, may have tubes which are integral with the sheet, being
25 formed by wrapping over an edge of the polythene and bonding the polythene to itself.

Because a polythene sheet is generally laid directly on the ground, the tubes may be filled with water as the sheet is
30 unrolled over the field. For example, an elevated portable water tank may be positioned at the start of the sheet, and connected via hoses to the tube or tubes. As the sheet is unrolled, water may then flow under gravity into the tubes as the roll is unrolled. Once the sheet is in place, the
35 ends of the tubing may be sealed as described above. A

38.1 mm diameter tube will consume about 600 kg of water per 500 m length of tube. This is a relatively modest amount of water, and so a tank may readily be positioned in the field by a tractor to fill the tubing as the field is covered.

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The crop covering according to the invention, may be manufactured in long lengths, and rolled into rolls. These rolls can be handled in the field in a conventional way to spread the covering over the crops. Tubes running the length of the material may readily be filled with water to hold down the sheet with a consequent reduction in the time and labour needed to secure the sheet to the ground.

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The crop covering may also eliminate the need to have gaps between adjacent sheets, for example for digging the sheet into the ground. Such wasted space may account for 5% of the area of a field.

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The crop covering may also be adapted for use on a smaller scale, for example, in a home gardener's vegetable patch.

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A crop covering according to the invention therefore may find widespread applicability wherever there is a need to protect crops from the weather, or to contain a pesticide, fungicide or herbicide.

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Claims

1. A covering for crops comprising a length of sheet which may be laid over the crops and at least one tube retained to the sheet, in which water may be introduced into the tube to hold down the sheet when the sheet is laid over the crops, and in which the water may be let out of the tube when the sheet is removed from the crops.
2. A covering as claimed in Claim 1, in which a tube is retained along the length of at least one side of the sheet.
3. A covering as claimed in Claim 2, in which a pair of tubes are retained along the length of opposite sides of the sheet.
4. A covering as claimed in Claim 3, in which each of the pair of tubes is adapted to be visually distinguishable from the other so that one side of the sheet may be visually distinguished from the opposite side.
5. A covering as claimed in any preceding claim, in which the tube is adapted to lay flat when the tube is empty.
6. A covering as claimed in any preceding claim, in which the tube is attached directly to the sheet.
7. A covering as claimed in Claim 6, in which the tube is attached to an edge of the sheet.
8. A covering as claimed in Claim 7, in which the edge of the sheet is wrapped around the tube to retain the tube.
9. A covering as claimed in Claim 7, in which the edge of the sheet is bonded to the tube.

10. A covering as claimed in Claim 7, in which the tube is integral with the sheet.

5 11. A covering as claimed in any preceding claim, in which the tube, when full of water weighs at least 0.1 kg per metre length of tubing.

10 12. A covering as claimed in Claim 11, in which the tube, when full of water weighs between 0.3 kg and 1.2 kg per metre length of tubing.

13. A covering as claimed in any preceding claim, in which the tube is double walled.

15 14. A covering as claimed in any preceding claim, in which a number of tubes are bundled together.

20 15. A covering as claimed in any preceding claim, in which the tube is open-ended, and retention means are provided at each end of the tube to retain water in the tube once the tube is filled.

25 16. A covering as claimed in Claim 15, in which the retention means comprise a knot tied in an end of the tube.

17. A covering as claimed in Claim 15, in which the retention means comprise a valve press-fitted into an end of the tube.

30 18. A covering as claimed in Claim 15, in which the retention means comprise a clip applied to the outside of the tube to pinch off water flow past the clip.

35 19. A covering as claimed in any preceding claim, in which the length of sheet is rolled up into a roll when not laid

over the crops.

20. A covering as claimed in any preceding claim, in which the sheet is a fleece material.

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21. A covering as claimed in any preceding claim, in which the sheet is polythene.

22. A method of covering crops with a covering, the covering being as claimed in any one of claims 1 to 21, the method comprising the steps of:

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a) placing the covering over the crops; and

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b) introducing water into at least one tube.

23. A method as claimed in Claim 22, when appendant to Claim 21, the method comprising the following steps before step a):

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c) unrolling the roll of sheet; and

d) optionally, cutting the length of sheet to the length required to cover the crops.

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24. A method as claimed in Claim 22 or Claim 23, the method comprising the following steps after step b):

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e) repeating steps a) and b) to lay parallel lengths of sheet across a field of crops; and

f) overlapping a tube of one length of sheet over a tube of an adjacent length of sheet.

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25. A method as claimed in any one of Claims 22 to 24, the

method comprising the steps after step b):

g) letting water out of the tube; and

5 h) removing the covering from the crops

26. A method as claimed in Claim 25, when appendant to Claim 21, the method comprising the step after h):

10 i) rolling the sheet back up into a roll.

27. A covering for crops substantially as herein described, with reference to and as shown in the accompanying drawings.

15 28. A method of covering crops substantially as herein described, with reference to and as shown in the accompanying drawings.



Application No: GB 9607360.6
Claims searched: 1 to 28

Examiner: Paul Makin
Date of search: 5 July 1996

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.O): A1E (EAGX ; EAF)

Int CI (Ed.6): A01G 13/02

Other: Online : WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 1019306 (R.A.LISTER) Whole document	1,2,3,4,6,7,11,12,22
X	US 4833822 (DIGRASSI) Whole document	1-7,9,10,11,12,15,17,21
X	FR 2722945 (SOC DU <i>et al</i>) see the figures and WPI Acc No. 96-11880/13	1-6,11,12,19,21,22,23,25,26
X	FR 2560742 (SCOARNEC) see the figures and WPI Acc No. 85-265246/43	1-8,11,12,13,15,17,21,22
X	FR 2544960 (RONTEIX) see the figures and WPI Acc No. 84-308499/50	1-7,10,11,12,15,17,18,21,22,25.

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